

IN THE CLAIMS:

Claims 1, 2, 7, and 11 through 15 have been amended herein. All of the pending claims 1 through 19 are presented below. This listing of claims will replace all prior versions and listings of claims in the application. Please enter these claims as amended.

Listing of Claims:

1. (Currently amended) A method for connecting a solder bump of an array of solder bumps on a semiconductor device and a contact site of a plurality of conductive contact sites of a member, comprising:
heating the solder bump of the array of solder bumps to a softening-temperature T_s -temperature T_s below a melting temperature of the solder bump of the array of solder bumps; and
contacting the contact site of the plurality of conductive contact sites by the solder bump of the array of solder bumps of the semiconductor device using a pressure less than substantially 22 grams-force.
2. (Currently amended) The method of claim 1, wherein the melting temperature of the solder bump of the array of solder bumps is $T^{\circ}\text{C}$ higher than an ambient-temperature T_0 , temperature T_0 , and wherein the softening-temperature T_s -temperature T_s is in the range of about 0.5T to 0.95T above the ambient-temperature T_0 , temperature T_0 .
3. (Previously presented) The method of claim 1, wherein the solder bump of the array of solder bumps contacts the contact site of the plurality of conductive contact sites at a pressure not substantially exceeding about 10 grams-force.
4. (Previously presented) The method of claim 1, wherein the solder bump of the array of solder bumps contacts the plurality of conductive contact sites at a pressure in the range of about 2 to 10 grams-force.

5. (Previously presented) The method of claim 1, wherein the semiconductor device having the array of solder bumps is heated by one of hot air convection and infrared radiation.

6. (Previously presented) The method of claim 1, wherein the member having the plurality of conductive contact sites is heated by one of hot air convection, conduction from a heated object, and infrared radiation.

7. (Currently amended) The method of claim 1, wherein the semiconductor device and the member are placed in a temperature-controlled oven for heating to the softening ~~temperature Ts~~ temperature T_s.

8. (Previously presented) The method of claim 1, wherein the semiconductor device is held in a chuck, the chuck being heated.

9. (Previously presented) The method of claim 1, wherein the member is held in a chuck, the chuck being heated.

10. (Previously presented) The method of claim 1, wherein the member having the plurality of conductive contact sites is heated by electrical resistance wires.

11. (Currently amended) The method of claim 1, wherein the member and a substrate are mounted on a mounting board having an integral heater, the integral heater controlled to heat the member to the softening ~~temperature Ts~~ temperature T_s.

12. (Currently amended) The method of claim 1, wherein the array of solder bumps comprises Sn-Pb solder having a lead content in the range of about 40 to about 98 percent, and the softening ~~temperature Ts~~ temperature T_s comprises a range of about ~~140~~ 140°C to 180°C.

13. (Currently amended) The method of claim 1, wherein heating comprises predetermining a heating time ~~X~~ time X to heat the solder bump of the array of solder bumps to the softening temperature ~~T_s~~, temperature T_s, and heating for the time ~~X~~ time X.

14. (Currently amended) The method of claim 1, wherein heating comprises initiating the heating, measuring a temperature of one of the member and the semiconductor device, and stopping the heating to limit a temperature of the solder bump of the array of solder bumps to no more than the softening temperature ~~T_s~~, temperature T_s.

15. (Currently amended) An apparatus for connecting a solder ball to a contact site comprising:
a first member having a solder ball thereon;
a second member having a contact site;
apparatus for moving the first member against the second member for contact of the solder ball to the contact site, the first member contacting the second member at a pressure less than substantially 22 grams-force for the solder ball; and
heating apparatus for heating the solder ball and the contact site to a submelting solder-softening temperature ~~T_s~~, temperature T_s.

16. (Previously presented) The apparatus of claim 15, wherein the contact site comprises one of a substantially flat surface, a recess for receiving a portion of a solder ball, and a recess having at least one projection therein for deforming a solder ball inserted therein.

17. (Previously presented) A testing apparatus for a semiconductor package having a ball grid array of solder balls on a surface thereof, the apparatus comprising:
an insert formed of generally noncompliant material, the insert having a first surface including an array of contact sites for contacting the ball grid array of solder balls and having a second surface;
a substrate having a first surface, having a second surface, the second surface of the insert secured to the first surface of the substrate, and having a pattern of leads on the substrate for connecting to contact leads in a socket;
electrical leads connecting the array of contact sites of the insert with the pattern of leads of the substrate;
a test board having the socket with the contact leads connected to a testing circuit, the substrate and the insert for insertion into the socket for contact of the pattern of leads of the substrate with the contact leads of the socket; and
heating apparatus associated with at least one of the substrate, the insert, and the socket.

18. (Previously presented) The apparatus of claim 17, further comprising temperature-sensing apparatus attached to one of the substrate, the insert, and the semiconductor package.

19. (Previously presented) The apparatus of claim 18, further comprising a temperature controller for controlling the heating apparatus.